

# *Mercury Monitoring Made Simple*



**Tekran Inc.**

NEW DIRECTIONS IN ENVIRONMENTAL TECHNOLOGY

# NOW there is an alternative to yesterday's methods of mercury vapour analysis.

## The Tekran Model 2537A Continuous Ultra-Trace Mercury Vapour Analyzer.

The Tekran® Model 2537A provides precision analysis while opening up a vast range of applications that are too expensive, impractical or simply not possible using prior methods.

The Model 2537A performs continuous measurement of total gaseous mercury (TGM) in ambient air with an update rate as low as 2.5 minutes and a detection limit of  $<0.1 \text{ ng/m}^3$  (*12 parts per quadrillion by volume*). The analyzer is self-contained, compact, rugged and versatile. It can easily be used in field and mobile applications.

The Model 2537A is capable of continuous, unattended operation. It eliminates the expense and uncertainty of previous manual techniques. What's more, it makes the difficult task of ultra-trace, real-time mercury determination simple and routine.

The Tekran® Model 2537A is a significant advance in the art of ultra-trace mercury analysis and since its introduction has become a standard tool for governments, research institutions, industries and universities throughout the world.



### Applications

- Continuous background measurement.
- Urban airshed monitoring.
- Source localization.
- Plume dispersion profiling.
- Seismic activity forecasting.
- Mercury surface exchange flux measurements.
- Dissolved Gaseous Mercury (DGM) in waters.
- Mercury in other media.

## Principles of Operation

- Preconcentration by amalgamation onto patented pure gold collector cartridges.
- Thermal desorption of the captured mercury in an inert gas environment.
- Detection via cold vapour atomic fluorescence spectrophotometry (CVAFS).
- One cartridge samples and collects while the other is being analyzed, yielding continuous sampling of the input stream.

## Features

- Patented dual cartridge design.
- Capable of unattended operation for extended periods.
- High precision mass flow meter provides accurate measure of total sample volume.
- Ultraviolet excitation source is temperature controlled and features closed loop optical intensity control for optimum stability.
- Simple menu based operation allows modifications of all operational parameters to suit any monitoring application.

```
MAIN MENU          98-02-15 10:33:17
CALIBRATE RUN METHOD SETUP
```

*Simple menu based operation.*

```
RUN: LAST      A Hg:      3.2  ng/m3   2
Average:      300 sec   Volume:   7.5.1
98-02-15      10:25:00
<esc><esc> to STOP  <esc><next> to STEP
```

*Multiple screens display complete RUN information.*

## Inputs

- Status inputs allow logging of up to three event conditions.
- Control inputs allow remote contact closures to trigger a calibration cycle, perform a zero check, or perform a standard addition (spike) into the sample stream.



The Model 2537A

outputs to  
a variety  
of recording  
devices.

## Outputs

- Two independent 0-5 V analog outputs may be programmed to output the last measured mercury concentration or a host of internal instrument variables.
- Status outputs allow remote determination of instrument conditions.
- RS-232 serial output provides a detailed record of each reading, each calibration, and all instrument settings. The output may be easily imported into any spreadsheet, data base or data display application.

## Calibration

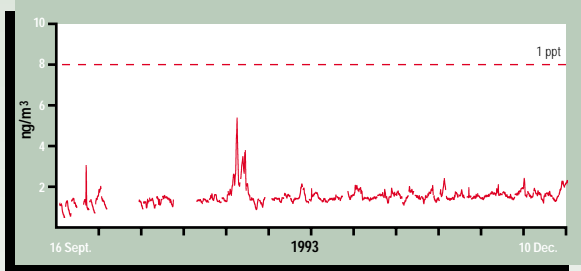
- Injection port for manual calibrations using standard gas tight syringes.
- Internal permeation source (optional) allows automatic unattended recalibrations at user specified intervals.

Date	Time	Typ	C Stat	AdTim	Vol	Bl	BlDev	MaxV	Area	ng/m3	
97-06-30	18:33:40	CLN	A OK	0	0	.00	0.161	.081	0.162	2183	0.000
97-06-30	18:37:16	CLN	B OK	0	215	5.45	0.161	.093	0.162	3211	0.000
97-06-30	18:40:00	CONT	A OK	0	300	7.48	0.160	.088	0.193	78584	2.194
97-06-30	18:45:00	CONT	B OK	0	300	7.50	0.160	.094	0.189	69474	1.949
97-06-30	18:50:00	CONT	A OK	0	300	7.50	0.160	.091	0.189	67142	1.870
97-06-30	18:55:00	CONT	B OK	0	300	7.50	0.161	.086	0.188	67030	1.881
97-06-30	19:00:00	CONT	A OK	0	300	7.50	0.161	.087	0.189	68815	1.917
97-06-30	19:05:00	CONT	B OK	0	300	7.50	0.161	.078	0.189	68346	1.918
97-06-30	19:10:00	CONT	A OK	0	300	7.50	0.161	.095	0.189	69712	1.941
97-06-30	19:15:00	CONT	B OK	0	300	7.50	0.160	.082	0.188	66775	1.874

*Sample Serial output.*

## Continuous Background Monitoring

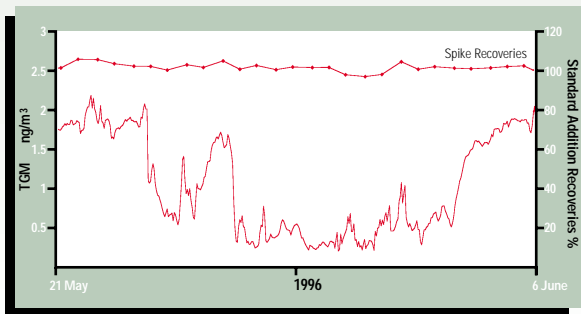
The Model 2537A is being used to monitor background and urban mercury levels around the world. The ability to operate continuously and to self calibrate allows it to function unattended in remote regions.



Courtesy Ontario Ministry of the Environment

### Dorset Ontario

This graph shows continuous background measurement in a remote part of Ontario, Canada. The dashed red line indicates a level of one part per trillion (volume based). Though levels never approach even this value, the mercury levels in fish in the area exceed one part per million. This represents bio-accumulation by a factor greater than one million times. The values in fish are high enough that consumption limits are in place for several species.



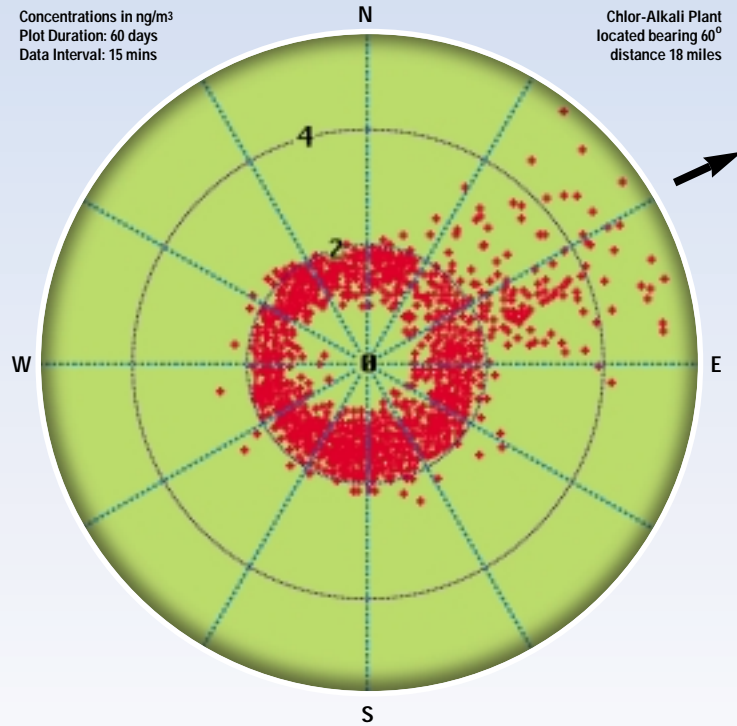
Courtesy Environment Canada

### Arctic Monitoring

A Model 2537A has been in continuous operation at Alert, in the Canadian Arctic for years. One of the most surprising findings was that, during polar sunrise there are periods when gaseous mercury levels suddenly drop to the lowest values recorded anywhere on the planet. The horizontal line at the top of the graph shows "Spike Recoveries" during the period. A Model 1120 Standard Addition Unit was used to periodically activate the internal calibration source of the analyzer, adding a known amount of mercury to selected ambient air samples. The recovery of this added mercury was then calculated, assuming that the background mercury level was the mean of the readings before and after the spike. This is an invaluable QA/QC tool in that it demonstrates proper operation of the analyzer, even when low readings are observed. In this graph, the recoveries were close to 100% over the entire period, showing that the low readings were not an artifact.

## Industrial Monitoring

The Tekran Model 2537A is capable of locating and measuring a wide variety of industrial pollution sources.



### Wind Direction versus Mercury

This wind rose plot illustrates the results of approximately two months of continuous monitoring. Elevated readings from the Northeast are clearly discernable, even though the source is over 18 miles distant. Most of this southern US state has elevated mercury concentrations in fish, necessitating a public health consumption advisory.

## A Wide Array of Uses...



The Limnos research vessel is used for a variety of environmental studies on the Great Lakes. In addition to the Limnos, Tekran equipment has been used aboard a variety of vehicles over air, sea and land.



The Tekran Model 2537A inside the monitoring van is being used by Oak Ridge National Laboratories to monitor mercury emissions from ground covering a landfill in Florida. A Teflon flux chamber is visible in the foreground.



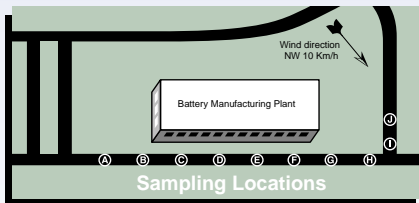
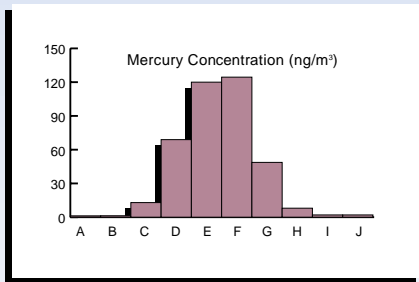
Mercury researchers from around the world gather in the Nevada desert to monitor mercury fluxes from naturally enriched soils.



The researchers brought a total of twelve Tekran 2537A analyzers and ran them in open tents. Despite the harsh conditions and extremes in temperature, the units operated flawlessly.



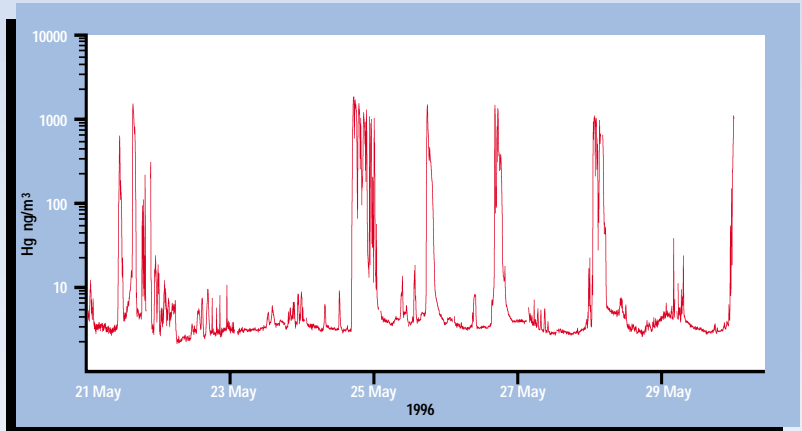
The Tekran analyzer has been validated in a number of international intercomparisons. One of the earliest such studies took place at a waste treatment plant in Windsor, Ontario.



Courtesy Ontario Ministry of the Environment

### Down Wind Plume Profile - Battery Manufacturing Plant

The rapid response time and continuous analysis capabilities of the Model 2537A allow the localization and characterization of low level industrial sources. The figure above illustrates the results of a single downwind traverse of a battery manufacturing facility. The measured dispersion of the plume closely approximates the expected gaussian distribution. The entire survey took less than one hour to complete.

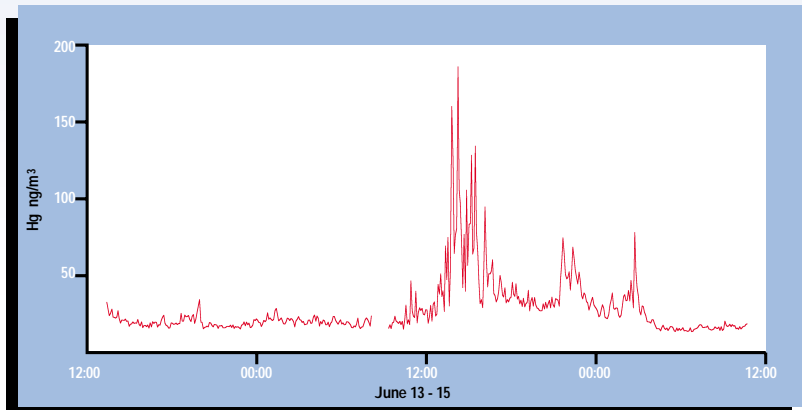


Courtesy US EPA, Region IV

### Burlington, Georgia - LCP Superfund Site

This graph illustrates the wide dynamic range of the Model 2537A. Background levels of 1-2 ng/m<sup>3</sup> as well as downwind levels of > 1100 ng/m<sup>3</sup> were measured without changing range or recalibrating. Note that the mercury concentration scale is

logarithmic. The sharp peaks correspond to winds aligned with the source, approximately one mile away. Since this survey was performed, over 423,000 lbs. of mercury were removed from this superfund site.



Courtesy GKSS, Germany

### Abandoned Industrial Facility - Former GDR

A number of obsolete, highly contaminated industrial plants were closed after Germany was united in the early 1990's. The remarkable feature of this graph is that these readings were taken 1 km upwind of the source: an abandoned chlor-alkali

plant. These values are over one hundred times normal background levels and are due to emissions from highly contaminated soil around the site.



Another intercomparison took place in rural Wisconsin. Both Tekran analyzers and manual cartridge monitoring equipment were housed in the building at the base of the tower.

Tekran analyzers have been used for detecting mercury emanating from geological faults. As evidenced above, operation in caves and mine shafts poses no problems.

Tekran analyzers have long been in continuous use at Alert, the most northerly continuously inhabited outpost in the world.

The data acquired at this background site provide valuable information on the global transport of mercury.

Further information on these and other studies is available at our website: <http://tekran.com>

## Accessories



1110



1120



2505

As the variety of applications grows, Tekran is committed to providing a range of accessories and support products to meet our customers' monitoring needs now and in the future.

Some examples:

<b>Model 1100</b> <i>Portable Zero Air Generator</i>	<b>Model 1120</b> <i>Standard Addition Controller</i>
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<b>Model 1110</b> <i>Two Port Synchronized Sampler</i>	<b>Model 1130</b> <i>Reactive Gaseous Mercury (RGM) Speciation Unit.</i>
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**Model 2505**  
*Portable Manual Injection Source for QA/QC and auditing purposes.*

## Specifications

<b>Detection Limit:</b> <i>(7.5 litre samples)</i>	< 0.1 ng/m <sup>3</sup>
<b>Range:</b>	0.1 - 10,000 ng/m <sup>3</sup>
<b>Linearity:</b>	2%
<b>Flow Rate:</b>	0.5 - 1.5 LPM
<b>Sample Cycle Time:</b>	2.5 - 60 min.
<b>Rise Time &gt; 95%:</b>	Within one cycle
<b>Fall Time &gt; 95%:</b>	Within one cycle

<b>Warm up Time:</b>	
Instrument:	15 min.

<b>Dimensions:</b>	
Width:	17.0" (432 mm)
Height:	8.75" (220 mm)
Depth:	22.5" (572 mm)
Rack Mounting:	19" EIA

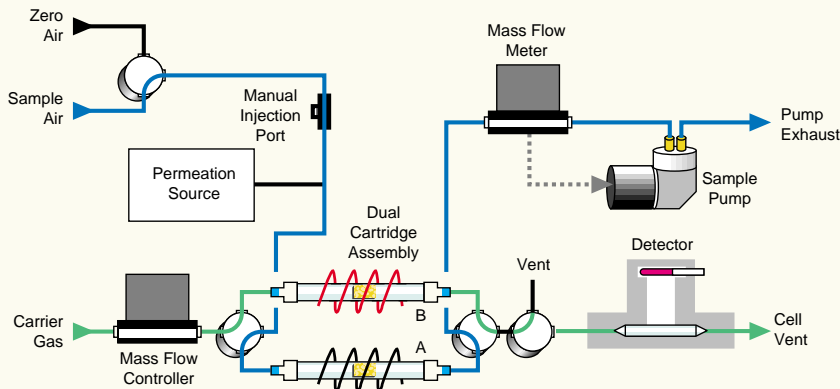
<b>Weight:</b>	
Instrument:	50 lb. (23 kg)
Shipping:	70 lb (32 kg)

**Power Requirements:**  
100/120V  
220/240 V, 50/60 Hz  
200 VA max, 100 VA avg.

Due to continuous product development, specifications are subject to change without notice. Tekran® Registered Trademark of Tekran Inc.

Patented: US Pat. No. 5,660,795 & 5,597,535.  
(Other US and international patents pending.)

## Flow Diagram



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